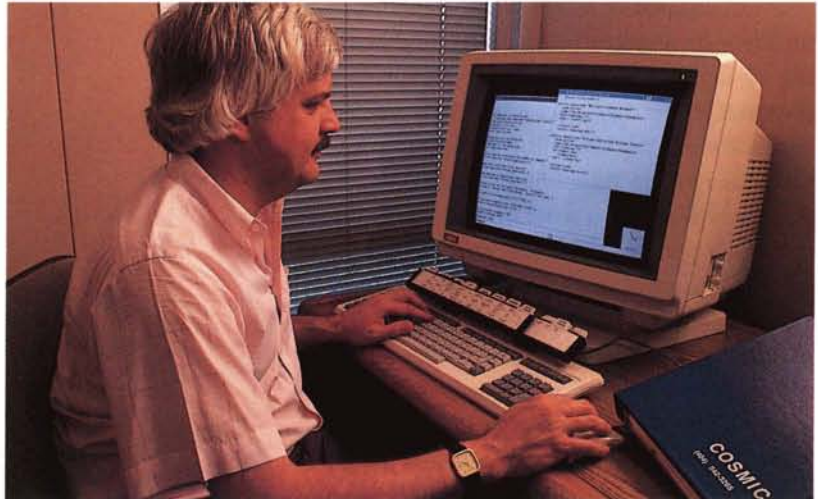# Expert System Software

To help boost national productivity, NASA offers assistance to computer-using American businesses by providing a way to effect significant reduction of automation costs: use of government-developed computer programs that can be adapted to secondary usage. NASA's mechanism for making such programs available to the private sector is the Computer Software Management and Information Center (COSMIC)®, located at the University of Georgia.

An example of a widely-used COSMIC program is CLIPS (C Language Integrated Production System), a software shell for developing expert systems. Originally developed by Johnson Space Center, CLIPS is designed to allow research and development of artificial intelligence on conventional computers. CLIPS enables highly efficient pattern matching. A collection of conditions, and the actions to be taken if these conditions are met, is built into a rule network; additional user-supplied facts pertinent to a particular problem are matched to this rule network. CLIPS' versatility has made it a valuable research tool for a variety of applications. Some examples:

Chemical production machines at E.I. DuPont de Nemours & Company, Wilmington, Delaware require constant monitoring of product quality and quantity. The company has embedded a watchdog expert system in the CLIPS shell. Use of CLIPS allows a user to isolate productivity problems and work toward their solutions in the absence of a machine expert.

Under a grant from IBM, the Computer-Aided Productivity Center at California Polytechnic State University is investigating the role of artificial intelligence in computer-aided design. CLIPS has been interfaced to a knowledge base of design rules and solutions. Through question and answer sessions, CLIPS responds to requests for information and provides continuous background monitoring of an evolving design.

Mentor Graphics, San Jose, California used CLIPS as the developmental core of a new Circuit Synthesis System. The system employs a series of "knowledge modules" that provide expertise in disciplines that a user engineer lacks; for example, it allows a *digital* engineer to synthesize many *analog* schematic designs; above, Mentor employee Richard Aikers is using the system to generate a schematic that implements the design specifications he has typed on the screen. The Contour program queries the designer for pertinent circuit data and uses a selected knowledge module to synthesize the schematic. CLIPS acts as an interpreter between the user inputs and the knowledge base.

Tom Brooke of the China Grove, North Carolina law firm of Brooke & Brooke uses CLIPS to help him decide which facts from a casefile are most pertinent and should be included in his legal pleading for the court. CLIPS is interfaced to a word processor and a file of case facts; in question/answer exchange, CLIPS selects facts to be merged with paragraphs in the files that are to be included in the pleading.